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Two-carrier Analysis of a- and m-ZnO Thin Films W.C. HSIEH, Q.Y. CHEN[1], P.V. WADERKAR, H.C. HUANG, Y.F. CHENG, C.F. CHANG, K.H. LIAO, S.Y. LAI, H.H. KO, Q.J. LIN, W.Y. LIN, National Sun Yat-Sen University, Kaohsiung, Taiwan, H.W. SEO, University of Arkansas, Little Rock, Arkansas, USA, C.H. LIAO, ROC Military Academy, Kaohsiung, Taiwan, H.H. LIAO, Enli Technology Inc., Kaohsiung, Taiwan, L.W. TU, N.J. HO, National Sun Yat-Sen University, Kaohsiung, Taiwan, D. WIJESUNDERA, W.K. CHU, University of Houston, Houston, Texas, USA — Thin films of a- and m-plane oriented ZnO have been produced, respectively, on r- and m-sapphire substrates, all demonstrating reasonable crystalline qualities as judged by the X-ray diffractornetry. Contrary to most reported, the samples all demonstrated p-type charge carriers determined by Hall measurement using a Quantum Design PPMS system. The I-V curves of All-ZnO p-n junctions all demonstrate the characteristic nature of diodes. These two measurements provide unambiguous evidences of p-type behaviors. However, there are some irregularity in Hall measurement and magneto-resistivity. In order to understand the origin, we conducted a two-carrier analysis of the Hall data taken over a wide range of temperatures (T) and magnetic fields (B). The dependence of Hall resistivity and MR on B as T and the existence of hysteresis, we speculate, possibly reflect the complex atomic defects and their mobile nature in the otherwise largely perfect crystalline lattices.

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